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Developing a Multi Criteria Decision Analysis (MCDA) process for prioritization of NAMAs

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Content

Abbreviations

BAP	Bali Action Plan
BAU	business as usual
CBA	cost-benefit analysis
COP	Conference of the Parties
GHG	greenhouse gas
INDC	intended nationally determined contributions
LCDS	low-carbon development strategies
MCA	multiple-criteria analysis
MCDA	multiple-criteria decision analysis
MRV	measurement, reporting and verification
NAMA	nationally appropriate mitigation action
PAM	policies and measures
RE	renewable energy
SD	sustainable development
TCE	technical coordinating entity
UNFCCC	United Nations Framework Convention on Climate Change

Introduction

During recent years, Nationally Appropriate Mitigation Action (NAMA) has become a key element of mitigation negotiations in the United Nations Framework Convention on Climate Change (UNFCCC) process. At present, NAMA is considered as a key tool to be used by developing countries to structure and promote their potential emission reductions.

Most countries are in the process of identifying NAMAs at national level. In order to select the NAMAs to be implemented first, many countries are willing to establish NAMAs prioritized list at national or sectoral level. A prioritization process will also be relevant as next year countries will have to translate their mitigation contribution outlined in their INDCs submitted to UNFCCC into implementation plans.

Multiple-criteria decision analysis (MCDA) is a tool commonly used for decision making process, including to rank options or to short-list a limited number of options. This tool allows combining some criteria which are valued in monetary terms and others for which market values are not readily available in the economy. It allows the use of a full range of social, environmental, technical, economic, and financial criteria. MCDA is thus an appropriate tool to prioritize NAMAs in the context of national sustainable development, taking into account climate and development priorities.

The objective of the publication is to enhance the knowledge of national stakeholders, in particular policy makers and decision makers, to understand the process for developing and applying a framework for NAMA prioritization (referred as NAMA Prioritization Process). The publication will address the technical aspects related to the use of the MCDA tool and the institutional arrangements to implement an MCDA process, both in the context of NAMAs prioritization. Philippines is used as case example to illustrate the application of MCDA in a country-specific context.

It should be noted that international community uses the term 'NAMA' for both nationally determined voluntary mitigation action to address GHG emissions and specific mitigation actions identified at the sectoral, sub-sectoral or local levels. In the rest of this paper, the term NAMA will refer to specific mitigation action.

The first chapter gives a brief overview of the origin of the NAMA concept and describes how the concepts of NAMA has evolved through the different Conferences of Parties (COPs), as well as what is the place of NAMAs in context of the new climate agreement 2015. The first

chapter also addresses the importance of prioritizing NAMAs for a country. The second chapter introduces the MCDA tool and the common use of the tool for policy decision making process. This chapter describes the common steps to be followed when applying the MCDA tool and defines the key concepts and parameters related to the tool. The chapter addresses also the basic underlying mathematical aspects of the tool through simple practical example. The third chapter proposes a general overview of the NAMA prioritization process. This chapter describes briefly the key steps in the process and the key stakeholders involved in these steps. The next chapters (fourth and final) describe in detail the two phases of the process, *i.e.* Defining the framework and Prioritizing NAMAs. Finally, the last chapter addresses the political endorsement of priority NAMA ideas, the creation of a national registry and how the last steps of the NAMA prioritization process connect to a general NAMA cycle.

This publication is the third of a series of three studies on NAMAs prepared with support from the South East Asia Network of Climate Change Offices (SEAN-CC).[1]

[1] The two previous publications, published in 2014, are "Nationally Appropriate Mitigation Action: Understanding NAMA Cycle" and "Nationally Appropriate Mitigation Action: Understanding the MRV framework for developing countries" available at http://www.unepdtu.org/PUBLICATIONS

Chapter 1

BACKGROUND

During the recent years Nationally Appropriate Mitigation Action (NAMA) became a key element of the mitigation framework in the United Nations Framework Convention on Climate Change (UNFCCC). At present NAMA is considered as a key policy tool for developing countries to address their emissions reductions. Many countries are in the process of identifying specific mitigation actions and developing detailed plans to implement these actions.

The concept of NAMA originated in the Bali Action Plan (BAP) adopted by the Parties to the UNFCCC in 2007 during COP13[2]. The subsequent COPs held in Copenhagen (COP15 in 2009), Cancun (COP16 in 2010) and Durban (COP17 in 2011) have clarified the mitigation framework for developing countries, but none of the decisions have clearly defined neither the scope nor the content of NAMAs. Nonetheless, in context of the mitigation framework defined for developing countries, a NAMA can be considered as any mitigation action tailored to the national context, characteristics and capabilities, and embedded in national sustainable development priorities (Sharma and Desgain, 2013).

The mitigation framework agreed upon in COP16 for developing countries is based on the principle of voluntary efforts (UNFCCC, 2010). In this context, a NAMA will be nationally determined and voluntarily taken by a developing country to address its GHG emissions (Sharma and Desgain, 2013). In addition, the Cancun Agreements state that "developing country Parties will take nationally appropriate mitigation actions…, aimed at achieving a deviation in emissions relative to 'business as usual' emissions in 2020;". This provides a common goal for all developing countries to mitigate their GHG emissions.

The Copenhagen Accord noted at COP15 uses the term "supported NAMA" to refer to NAMA seeking international support for their implementation (UNFCCC, 2009). The Cancun Agreements (UNFCCC, 2010, *ibid.*) adopted by Parties during COP16 distinguish between internationally supported actions and domestic supported actions depending on whether they are implemented with or without international support.

Two other elements have evolved together with the concept of NAMA, the measurement, reporting and verification (MRV), and the international support. MRV is an important component of NAMA mentioned for the first time in the BAP and further addressed in the

[2] BAP states that in order to "Enhanced national/international action on mitigation of climate change…" developing countries will take "Nationally appropriate mitigation actions…in the context of sustainable development, supported and enabled by technology, financing and capacity-building, in a measurable, reportable and verifiable manner;...".

Copenhagen Accord and the Cancun Agreements which define the MRV framework for NAMAs[3]. International support for NAMA design and NAMA implementation is also an important element of NAMA as the Convention has clearly established that mitigation actions taken by developing countries will be internationally supported. The international support to developing country Parties for the preparation and implementation of their NAMAs was re-iterated in the Cancun Agreements[4].

The countries have initiated at Durban a new round of negotiations for defining the international mitigation framework under UNFCCC post-2020. The new climate agreement should be a universal agreement covering all the countries and would enter into force in 2020. It is expected that by 2015 all parties will come forth with their intended nationally determined contributions (INDC), including their GHG emissions targets, which will be implemented after 2020. The term "intended" implies that after submitting these contributions to UNFCCC, Parties will initiate a process review to confirm that the contributions are adequate to reduce the global GHG emissions to meet the 2°C goal. In the context of this review process, countries may be encouraged to increase their contributions, taking into account the principle of common but differentiated responsibilities. INDCs are expected to include mitigation goal/target set by country to address GHG emissions for the period 2020-2025 (or 2030). Developed countries are expected to continue taking economy wide emission reduction goal/target compared to a base year (e.g., 1990). In case of developing countries with higher capacities it is expected that INDC goal/target will be in form of an economy wide targets (reductions below BAU emissions or GHG intensity reduction compared to a base year), whereas, for other developing countries the goal/target could be a sectoral or policy goal/target but measurable in terms of GHG emission reductions. In this context NAMAs will be an important implementation tool to achieve the targets included in the INDC. Capacity development on the process of identifying and prioritizing NAMA will thus provide a sound foundation for developing countries to implement the international mitigation framework post-2020. This can help developing countries in creating necessary capacity for both, identifying prioritized NAMAs in pre-2020 as well as preparing them for post-2020.

As NAMAs are nationally determined, it is expected that the identification of NAMAs will be a country driven process and that NAMAs are tailored to the national context, characteristics and capabilities, and embedded in national sustainable development priorities (Sharma and Desgain, 2013). Further, NAMAs in post 2020 framework would be defined in the context of country's INDC. NAMAs can be identified in a large variety of sectors or sub-sectors where there is a potential for greenhouse gas (GHG) emission reductions based on sustainable development (SD) priorities. It is expected that the financing of NAMAs will be covered by combining national and international public finance as well as finance coming from private sector. In this context, it is of high importance for a country to be able to determine which NAMAs should be implemented first within one sector and through the different sectors,

[3] For further information on MRV concept, refer to Sharma and Desgain, 2013; Sharma, 2014; Sharma and Desgain, 2014.

[4] For further information on international support refer to Sharma and Desgain, 2013.

taking into account the mitigation potential, the sustainable development impacts and feasibility criteria of each NAMA. The use of a tool which allows comparing the NAMAs from different perspectives (mitigation, social, financial, environment) in order to prioritize them through a structured process will be key to supporting the policy decision making process.

Chapter 2

GENERAL DESCRIPTION OF MCDA TOOL

The process of prioritisation of policies can be facilitated by a variety of methods. Commonly a Cost-Benefit Analysis (CBA) is conducted. The CBA allows the user to weigh the potential monetary value of benefits and negative impacts of a policy, and thus rate various options for policies and measures (PAM) to identify which is most economically preferable (OECD, 2006). However, the CBA and similar tools that focus on cost-effectiveness of PAMs are limited in their analysis as, to apply these tools, the costs and benefits should be converted into monetary values that can be translated into economic impacts. These tools are thus difficult to apply for evaluating potential impacts of PAMs that cannot be easily translated into monetary values (Heinzerling and Ackerman, 2002; Mouter et al., 2015).

Development of the Multi-Criteria Decision Analysis (MCDA)

A variety of alternative policy assessment tools have been developed in order to respond to the CBA shortcomings. One of these is the Multi-Criteria Decision Analysis (MCDA), which allows for the inclusion of multiple criteria which go beyond monetary costs (DETR, 2009). The MCDA enables planners to prioritize PAMs by evaluating their impacts, including long term impacts that take into account intra-generational trade-offs, thus ensuring more sustainable development. Furthermore, as the MCDA includes other factors than monetary values, the analysis can include risks and impacts that are not market-based.

By applying a MCDA to various PAMs, it is possible for the planners to find the most preferential options. These preferential options are determined by evaluating and comparing the PAMs against a set of criteria that have been derived from pre-determined objectives. The different criteria are given scores and are weighted according to their importance in achieving the objectives. The final scores calculated for each PAM illustrate which are most able to achieve the desired objectives, and are thus deemed the most preferred options based on the multi-criteria analysis.

Thus the MCDA can be used to determine the single most preferred PAM, a suitable mix of PAMs, or possibly a prioritized shortlist. The flexibility of the MCDA means that while it is predominately used to determine the preferential PAMs, it can also be used to evaluate the impacts of PAMs´s implementation.

Key components of the MCDA

An MCDA requires three key components to analyse the PAMs. These components are defined below:

Objectives: The objectives referred to in this paper are those which the PAMs being considered should seek to achieve. The MCDA is used to determine which PAM(s) will be most suited to achieving those objectives.

Criteria: The criteria used in the MCDA are derived from the overarching objectives. The criteria are used to evaluate the extent to which PAMs contribute in achieving the objectives.

Indicators: Indicators are measureable parameters which allow qualitative and/or qualitative comparison of PAMs against a criterion. They thus can be measured either qualitatively or quantitatively, including in terms of monetary or non-monetary value.

These components are analysed using a matrix as exemplified in Figure 1.

			PAM 1	PAM 2	PAM 3
Objectives	Criteria	Indicators	Score	…	…
		Indicators	…	…	…
	Criteria	Indicators	…	…	…
		Indicators	…	…	…
	Criteria	Indicators	…	…	…
		Indicators	…	…	…

Figure 1: MCDA matrix sample

MCDA Process

A MCDA can be conducted according to the following steps:[5]

1. **Determining the objectives.** The objectives which the PAMs should seek to achieve are determined by decision makers and other stakeholders that are engaged in the process. When determining the objectives, it is important to ensure that they are anchored in the relevant national (e.g., social, political, institutional, etc.) context, and if applicable,

[5] The Steps described here are partially drawn from "Multi-Criteria analysis: A manual", 2009.

compatible and aligned with national objectives. It is not necessary for decision makers and stakeholders to distinguish a singular outcome or objective. Instead a higher level objective may be broken down into operationalised sub-objectives.

2. **Identify the criteria.** Having determined the objectives, the criteria for analysis are developed. There are many ways to develop criteria, for example they can be derived from expert assessments, stakeholder involvement, or policy makers working towards specific political targets. There is no set amount of criteria that is appropriate. Instead, the number of criteria should cover the whole range of objective.[6] The procedure for identifying and selecting criteria is as follows: following an initial brainstorming based on objectives, perspectives from interest groups are incorporated. The criteria are then sub divided into sub-criteria. This eases the following process of weighting.

3. **Identify the indicators.** While the identified criteria and sub-criteria represent the general direction of development desired in the objectives, the indicators provide measurable parameters of the performance of the different PAMs against the defined criteria. The criteria have to be operational, so they can be used to evaluate the performance of the options in achieving the objectives. The indicators can be expressed in both monetary and non-monetary values, and can also be both qualitative and quantitative.

4. **Weighting.** A central element of the MCDA analysis is the weighting of the criteria and corresponding indicators. The purpose of this step is to determine the relative preferences of a criteria/indicator over the others by giving a numerical value (i.e. the weight) that represents relative strength of a criterion. There are many ways to determine this scale, but typically it will involve multiple stages, and the inclusion of multiple stakeholders and decision makers. The methodology for weighting is further elaborated on later in this chapter.

5. **Identify the PAMs**. The PAMs are the options for achieving the overarching objectives. It is these options that are evaluated in the MCDA based on the above mentioned weighted criteria and indicators. While they are presented as the fifth stage here, the development of the options is a circular process, which often has already started before the development of the criteria for analysis. At this stage the options, be they policies, programmes, scenarios, individual projects, NAMAs, etc. are finalised, and included in the MCDA matrix as per Figure 1.

6. **Scoring.** The expected performance or impacts of the PAMs are now scored against the identified criteria. Typically the scores are placed on a scale where the most and least preferred scores are given the values 100 or 0 respectively. The remaining criteria are

[6] Ordinarily the range is between 6 -20.

then given scores on a scale between these two values. The methodology for scoring is further elaborated on later in this chapter.

7. **Examine the result.** The aggregated scores are calculated for each PAM based on the score and weight for each criterion. If a criterion has more than one indicator then score for the criteria is calculated based on the score and weight for each indicator. The aggregated scores reflect the relative performance of PAMs in achieving the objectives. Depending on what the purpose of the MCDA is, the analysis will provide a preferred policy option or set of policy options, or perhaps which projects to implement in order to achieve the overarching objectives.

8. **Sensitivity analysis.** Having completed the analysis, it is valuable to conduct a sensitivity analysis in order to check the accuracy and appropriateness of the scores and weights. Such an analysis is carried out by varying the weights of criteria/indicators. This will affect the aggregated scores, and may or may not change the order of the preferred PAMs significantly. If the order of the preference changes, it is important to analyse the reasons behind these changes to assess the appropriateness of the weights assigned to criteria/indicators and the reliability of the results.

Methodology for weighting and scoring

This section briefly outlines the methodology for weighting the criteria, and for calculating the aggregated scores of the PAMs against the criteria.

The basic formula to calculate the aggregate score for a PAM is shown below, where *i* is the *ith* PAM, *j* is the *jth* criterion, *m* is the weight, and *S* is the score:

$$S_i = \sum_j m_j \times S_{j,i}$$

Thus, the aggregated score of each PAM is the sum of the weighted value of score for each criterion. The method for calculating the aggregate score is demonstrated through an example shown below, where four policy options are evaluated against two criteria; private cost (indicator – total investment cost) and GHG reduction (indicator – total GHG emissions reduction) (Figure 2).

	Policy A	Policy B	Policy C	Policy D
Cost (Total investment cost in US$)	1200	1100	1500	1700
GHG Reduction (Total GHG emission reduction in ton CO_2e)	200	120	275	300

Figure 2: Criteria for policy options

Assigning weights

The weight of a criterion represents the relative preferences of a criteria/indicator over the other. The weight assignment is done in two steps. The first step captures the inherent preference of criteria and is based on a subjective assessment made by an expert. This is the basic weights. These weights are fixed once and may be reviewed if situation changes that effects the preference among various criteria.

Based on the scores shown in Figure 2, it is clear that some policy options are preferable to others on each of the two criteria. The most preferred (on cost criteria alone and GHG criteria alone) is highlighted in blue, and the least preferred (on cost criteria alone and GHG criteria alone) in gray (Figure 3).

	Policy A	Policy B	Policy C	Policy D
Cost (US$)	1200	1100	1500	1700
GHG Reduction (ton CO_2e)	200	120	275	350

Figure 3: Policy options by Cost and GHG Reduction

The most affordable policy (Policy B) is 600 US$ cheaper than the most expensive policy (Policy D), and yet reduces 230 ton CO_2e less. In order to evaluate which of these criteria has the highest relative importance, weights have to be assigned. The basic weight could be assigned through stakeholder consultations. Let us assume that both the criteria are equally important. This implies the basic weight for Cost and GHG criteria are 0.5 each. If the stakeholders think that the cost is a bigger constraint, for example given that low level of development capability to finance actions is low, cost could be a more important criteria than GHG in deciding which policy to pick. In this case the weight for Cost criteria will be higher than that for GHG.

The basic weights assume that the range of indicator value for each criterion is the same. If the indicator value range differs for each criterion, then an importance of the difference in the range (or swing of the indicator value) is also important to consider. In case of above example the swing in Cost indicator is 55%, whereas, swing in GHG criteria is 192%. Thus in this case for 1% increase in cost a significant % decrease in GHG could be achieved. Thus cost may not be as important, given the cost variation in policy options is not very high as the GHG reduction.

A simple way of accounting for such difference in swing is by normalizing the swing. To normalize the basic weights for swing variation, first is to calculate the percentage difference between the lowest and highest values (*i.e.* the swing) for each criterion (column 2 Figure 4). Next is to calculate the swing adjusted base weights (column 3 Figure 4). The criteria with highest swing is taken as base (criteria 2 in the figure 4 is assumed to have highest swing). BW in Figure 4 represents the base weight of a criterion. These generic formulae, given in Figure 4, can be used no matter how many criteria.

	Swing	Swing adjusted base Weights
Criteria 1	X1 = (Max - Min)/Max	((BW1/BW3)*X1) / ((BW1/BW3)*X1 +(BW2/BW3)*X2 +X3)
Criteria 2	X2(Max - Min)/Max	((BW2/BW3)*X2) / ((BW1/BW3)*X1 +(BW2/BW3)*X2 +X3)
Criteria 3	X3(Max - Min)/Max	X3 / ((BW1/BW3)*X1 +(BW2/BW3)*X2 +X3)

Figure 4: Swing adjusted weight calculation

Figure 5 shows the calculation for Swing adjusted base weights for the above example. The second column gives the swing for each criterion. As we can see the swing for GHG is about 4 times that for cost. Now using the approach explained above the swing adjusted base weights can be estimated as described in second column. Column 3 and 4 give respectively an example where the basic weights for Cost criteria and GHG criteria are the same and the case where basic preference for Cost criteria is twice that for GHG Criteria.

	Swing	Swing adjusted base Weights	Ex: BW1 = 0.5 BW2 = 0.5	Ex: BW1 = 0.66 BW2 = 0.34
Cost (US$)	(1700-1100)/1100 = 54.5%	R*54.5/(192+R*54.5)) Where R = BW1/BW2	1*54.5/(192+1*54.5) = 0.22	2*54.4/(192+2*54.5) = 0.36
GHG Reduction (ton CO_2e)	(350-120)/120 = 192%	(54.5/(192+R*54.5))	192/(192+1*54.5) = 0.78	192/(192+2*54.5) = 0.64

Figure 5: Swing and base weight calculation example

In the example, though basic weights are 0.5 and 0.5, due the higher variation in the values for the GHG indicator, the swing adjusted weights for GHG indicator are much higher. Thus GHG reduction is more important criteria then the cost. It means that even if the basic preference for the Cost indicator is made twice that for the GHG indicator, due to the much higher swing, the GHG indicator still gets a higher priority.

Scoring the options

Having assigned the appropriate weights for the different criteria, the scores of the options can be calculated. First the most preferred option is assigned a score of 100 and the least preferred option is assigned a score of 0 for each criterion identified. The remaining criteria will be given a score between 0 and 100. This is illustrated in the example shown in Figure 6 and Figure 7.

	Policy A	Policy B	Policy C	Policy D
Cost (US$)	1200	1100	1500	1700
GHG Reduction (ton CO_2e)	200	120	275	350

Figure 6: Scoring most and least preferred policy options

The remaining scores are calculated as shown in Figure 7:

	Policy A	Policy B	Policy C	Policy D
Cost (US$)	100x (Min C - indicator value)/(Min C - Max C) = 100 x (1700-1200)/ (1700-1100) = 83	100	100x (Min C - indicator value)/(Min C - Max C) 100 x (1700-1500)/(1700-1100) = 33	0
GHG Reduction (ton CO_2e)	100x (Indicator value - Min G)/(Max G - Min G) = 100 x (200-120)/(350 -120) = 35	0	100x (Indicator value - Min G)/(Max G - Min G) = 100 x (300-120)/(350-120) = 78	100

Figure 7: Calculation of remaining scores

As shown in Figure 7, the score for each criterion for an option is the ratio of: difference between the indicator value of criteria for that option and the minimum indicator value for that criterion; and, the difference between the highest and lowest indicator value for that option. In the case, such as the cost criteria where the lower value of indicator is more preferred, then the score is calculated as the ratio of: the difference between the maximum value of the indicator and the indicator value for that option; and, the difference between the highest and lowest indicator value for that option.

Finally, to prepare the total score for an option the weighted sum of score on each criterion for an option is calculated (as per formulae given above). Figure 8 demonstrates estimating total score for each of the policy options in the example defined. The normalized weights that were determined earlier, where the weight of Cost criteria is 0.19 and that for GHG criteria is 0.81, are multiplied with the scores as shown in Figure 8. The new weighted scores are added to give an overall weighted score.

	Policy A	Policy B	Policy C	Policy D
Cost (US$) **(0.19)**	0.36 x 83 = 29	0. 36 x 100 = 36	0.36x 33 = 12	0.36 x 0 = 0
GHG Reduction (ton CO_2e) **(0.81)**	0.64 x 35 = 22	0.64 x 0 = 0	0.64 x 78 = 50	0.64 x 100 = 64
Total	51	36	62	64
Policy Preference	3	4	2	1

Figure 8: Calculating weighted scores

The new weighted scores now reflect the relative importance given to the different criteria. It is now possible to see which policy options should be prioritised by the decision makers given their objectives, and the preferences captured in the weight for each criteria. The final results of the prioritization process are shown in the last row of Figure 8. Though in example the basic weight for Cost criteria is twice as important as GHG reduction, because of the swing in the indicator value for GHG criteria being higher, the GHG reduction is considered twice more important than the Cost criteria. This is so because for a small increase in cost the GHG reduction gained are high. The consequence of this is that Policy D is the most preferred option though it has highest cost. Policy C is almost as preferred as Policy D, because though the GHG reduction are 14% less than in Policy D, the cost is lower by 44%.

Chapter 3

NAMA PRIORITIZATION PROCESS

Prioritization process in the context of NAMA

As mentioned in chapter 1, NAMAs are mitigation options identified by developing countries in context of sustainable development goals and plans of the country. Identification and prioritization of NAMAs is a process that allows countries to screen their planned development activities and goals, and identify options to achieve the goals through the use of low carbon options. The underlying assumption is that the use of low carbon option doesn't impact the national sustainable development benefits negatively but may increase these benefits. Thus implementation of NAMAs doesn't change the priorities set up by country on plans and programmes for achieving sustainable development goals, but uses the planned activities to identify options to reducing GHG impacts of these activities.

The ideal case would be that a country could find resources, national and international, for implementing all the identified NAMAs. However, in real world situation, this is generally not possible and, hence, it is needed to establish the order of priority among identified NAMAs so that limited resources could be utilized in way that results in maximum benefits.

The primary benefit of NAMAs is reducing the GHG emissions compared to the business as usual (BAU) actions (*i.e.,* the scenario to implement the plans and programmes for national sustainable development goals in absence of NAMAs). Implementation of NAMAs could also increase the national sustainable development benefits compared to the BAU scenario, thus resulting in incremental sustainable development co-benefits. As an example, a country's sustainable development goal can be to increase the electricity generation capacity to meet the demand of all sectors of economy, while minimizing the adverse environmental impacts (deforestation, land degradation, air pollution, etc.) and minimizing dependence on imported energy. In the BAU case, this country may plan to achieve this goal through the use of coal based power generation with some hydro capacity. In order to minimize the impacts on loss of forests due to coal mines and hydro projects for compensatory afforestation, the country could develop a NAMA to replace some of the coal capacity by renewable energy (RE) to meet the electricity demand. The use of RE reduces the deforestation and thus conserves biodiversity increasing the sustainable development benefits compared to BAU. Further, using RE also reduces the transportation of coal and related air pollution, which also increases the sustainable development benefits. Thus the implementation of the RE NAMA increases the sustainable development benefits compared to the BAU scenario.

In prioritizing NAMAs, both, the GHG benefits and sustainable development co-benefits should be taken into account. The direct GHG benefits, *i.e.* the GHG emissions reductions, are easily quantifiable but can only be measured in terms of tonne of GHGs. It may also be possible to monetize the GHG benefits based on a carbon price, but estimating a single carbon price in itself may not be straightforward. The range of sustainable development co-benefits is wide. These co-benefits can be economic (increase in GDP, increased employment, higher exports, lower imports, etc.), social (gender equality, equitable economic opportunity, etc.) or environmental (lower air pollution, lower indoor air pollution, lower deforestation, etc.)[7]. The challenge in such prioritization process is of comparing diverse types of benefits, especially when not all the benefits can be quantified in a common currency. As mentioned in chapter 2, Multi Criteria Decision Analysis allows evaluation of multiple options against diverse criteria which could be quantitative and qualitative. Thus given the range of diverse benefits from NAMA implementation, MCDA seems to be a better tool than the usual cost-benefit analysis approach when prioritizing NAMAs/for NAMAs prioritization.

Prioritizing NAMA at sectorial level or national level?

The identification and development of long list of NAMAs could be both top-down or bottom-up process. In countries where low carbon development strategy (LCDS) or similar climate change mitigation analysis/policy exists, the NAMAs could be identified top-down, based on these strategies/policies (van Tilburg et al., 2011; Sharma and Desgain, 2014). In situations where LCDS is not yet prepared, it is likely that the process of the identification of a NAMAs long list will be bottom-up, with sectors and provinces identifying potential mitigation opportunities in context of their development plans. For example, in the case of Indonesia the national GHG mitigation plan (RAN-GRK) was developed bottom-up with sectoral line ministries and provincial governments identifying mitigation opportunities in the context of their development plans and programmes.

A natural question that arises is whether the NAMAs should be prioritized at sectoral level or national level. In most of the countries the allocation of resources for development plans is done at a national level as limited resources need to be allocated to ensure maximum benefits. A national level allocation allows comparing trade-offs and dependencies of actions across sectors. In addition prioritization at national level enables a more comprehensive comparison of GHG benefits and sustainable development co-benefits across the sectors and optimizing the use of limited resources. Prioritization at national level allows assessing the dependency of actions across sector and synergies. In the case that the prioritization is undertaken at sectoral level, one could end up in identifying NAMAs with lower total benefits compared to benefits from NAMAs identified through national level prioritization, if GHG benefits or sustainable development co-benefits of NAMAs in one sector are much greater than those in another sector. For example, if the each of the top four NAMAs in sector A have

[7] Note that "economic", "social" and "environmental" are the common categories used to define the sustainable development co-benefits related to NAMA implementation. Other categories can however be included, such as "institutional", according to the national context and national priorities of the country.

greater GHG impacts than the highest GHG impact NAMA in sector B, picking highest GHG benefit NAMA from each sector would result in total GHG benefits being lower than if top two NAMAs of sector A were implemented.

In the long run, given the limited carbon budget to limit the increase in temperature to below 2°C, developing countries emissions will have to peak and start reducing emissions. Thus NAMAs enable countries in taking advance actions to address GHG emissions which might help reduce long term costs of peaking and reducing GHG emissions in future. In this context, ensuring that priority NAMAs are in line with long term mitigation strategy would require a national level prioritization.

It has to be noted that a number of developing countries have established a climate finance coordinating mechanism to coordinate international support for NAMAs (Jha, 2014; Lütken, 2014). The allocation of limited international support would thus likely be considered at the national level and thus national level prioritization would be more appropriate.

NAMA prioritization process: general description

The NAMA prioritization process is embedded in a full NAMA cycle. A NAMA cycle will start with the identification and prioritization of NAMA ideas based on the LCDS/national climate strategy and will end with an assessment of the implementation of this strategy (Sharma and Desgain, 2014). In such a NAMA cycle, the steps following the identification and prioritization of NAMA ideas will be the political endorsement of prioritized NAMA ideas, the submission of the NAMA ideas to the UNFCCC Registry and the NAMA design and formulation. The identification of potential NAMAs and the prioritization of the corresponding NAMA ideas are thus the first steps of a larger process. Both steps are implemented at national level and will be country-driven.

Figure 1 proposes a general NAMA prioritization process. The figure shows the steps involved in establishing the prioritization process, where the identification of NAMAs comes into the process, the key reports produced during the process, and the interaction of the NAMA prioritization process with the next steps of the full NAMA cycle.

The NAMA prioritization process as shown in Figure 1 has seven steps that follow the logic of a MCDA process: Defining objectives, Identification of criteria and indicators, Weighting of criteria and indicators, Scoring, Examine the results, Sensitivity analysis, and Compilation of the results. The first three steps constitute the “Defining the framework” phase and the remaining steps constitute the “Prioritizing NAMAs” phase. Prioritizing NAMAs phase uses the output of the NAMAs identification step.[8] Two key reports are also shown in Figure 1, the “NAMA idea list” which is the product of the NAMAs identification step and used as

[8] This step is part of another process which has been called NAMA cycle in Sharma and Desgain, 2014.

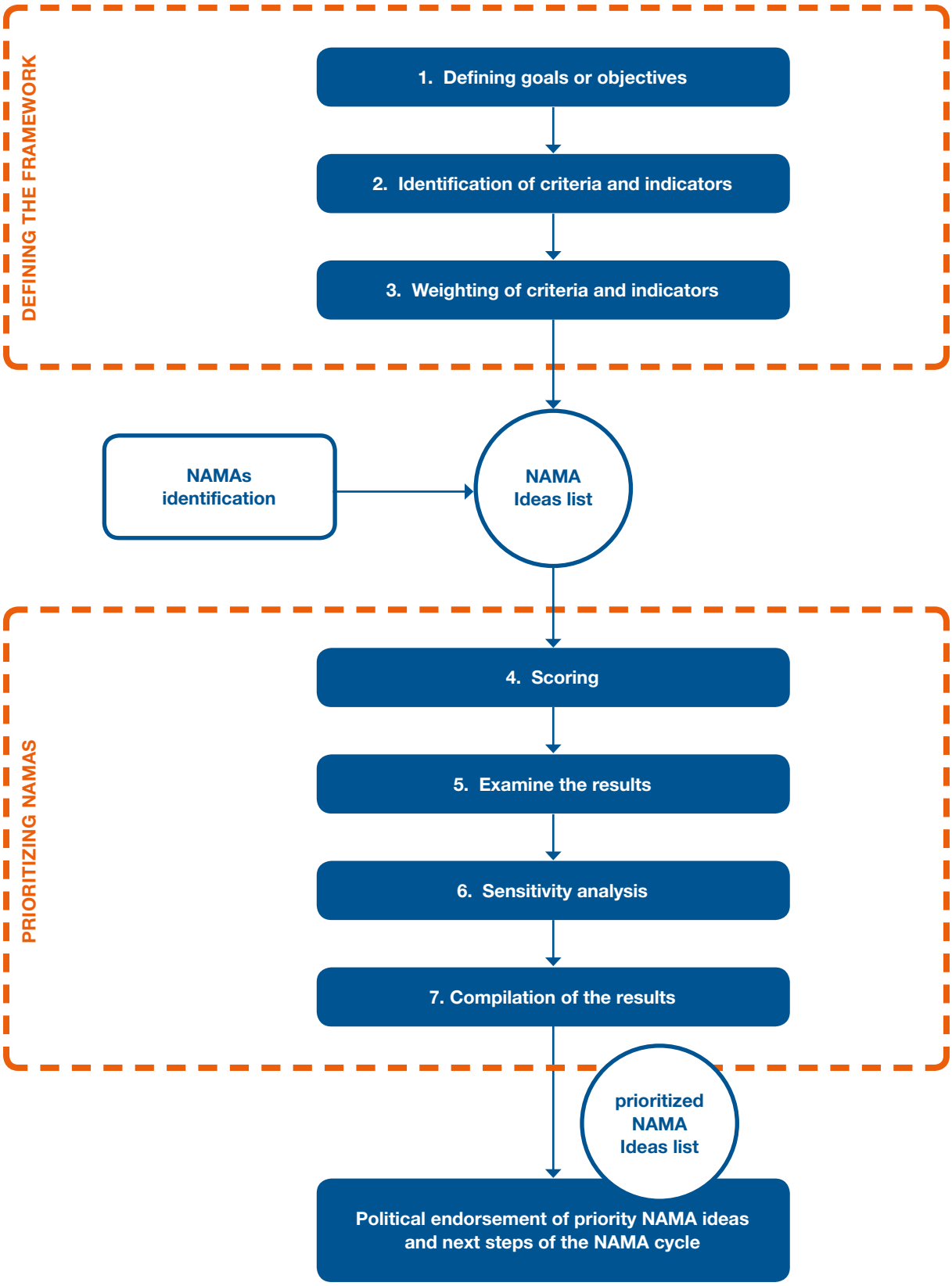

Figure 1: NAMA prioritization process

an input for Scoring, and the "prioritized NAMA ideas list" which is the final product of the prioritization process.

The first step in the NAMA prioritization process is **Defining objectives**. As mentioned in chapter 2, the objectives refer to the final desired results that the NAMAs should seek to achieve. The objectives are identified taking into account the national context and development priorities. These objectives may have already been determined by decision makers and be defined in national development strategies. Defining the objectives allows defining the general framework in which the NAMA prioritization process is anchored.

The second step in the NAMA prioritization process is the **Identification of criteria and indicators**. The criteria and their corresponding indicators are the parameters that are used to evaluate the performance of the different NAMAs in achieving the objectives. This is a very important step and criteria and indicators should be carefully selected, as they form the basis to compare the performance of the NAMAs. The full list of criteria and indicators should comprehensively capture the objectives defined at the first step from different perspectives including finance, social and environment.

The third step in the NAMA prioritization process is the **Weighting of criteria and indicators**. This step is usually performed as a direct continuation of the second step and is used to reflect the relative preferences of a criterion or indicator against the others. The weighting of criteria and indicators should take into account the objectives defined at first step and reflect the countries sustainable development and climate change priorities, e.g. priority to economic, social or environment aspects.

The fourth step in the NAMA prioritization process is the **Scoring**. This step involves scoring (*i.e.* assigning a value) each of the NAMA options against each of the indicators. This step will use the NAMA ideas list as the reference report for the NAMAs options that have to be compared. The NAMA idea list is the long list of NAMAs identified in the different sectors at national level. This list is the final product of the NAMAs identification step.

The fifth step in the NAMA prioritization process is the **Examine the results**. Once the weighting and scoring have been performed, final weighted scores can be calculated for each NAMA option. These final scores reflect the performance of each NAMA option in achieving the objectives defined in the first step, taking into account the importance given to each indicator. Based on the final scores of the different NAMA options a draft of a NAMA priority list can be established with the top priority NAMA having the highest score. At this stage, it is important that the stakeholders involved in the prioritization process examine the results of the prioritization to confirm whether the ordering reflects the priority taking into the national context.

The sixth step in the NAMA prioritization process is the **Sensitivity analysis**. At this step, the stakeholders assess the robustness of the prioritization process by modifying the weights of the criteria and indicators, and consider how the results in the draft of the NAMA priority list change accordingly. Indeed, by assigning one specific weight to each criteria and indicator it may result in erroneous results for the prioritization process. Therefore, it is necessary to consider how the results of the NAMA priority list can be affected by different relative weights among criteria and indicators.

The NAMA prioritization process ends with the **Compilation of the results**. The results of the NAMA prioritization process will be compiled in a report. This report will include the prioritized NAMA ideas list and will then be submitted to political endorsement. Once the results have been endorsed by high policy decision makers, the full NAMA cycle can be continued with the submission of the NAMA ideas to the UNFCCC Registry and the NAMA design and formulation.

Countries should consider the general NAMA prioritization process described in this paper as a guide to developing their own prioritization process based on the national processes for other programmes and based on the institutions and arrangements that are already in place in the country.

Chapter 4

DEFINING THE FRAMEWORK

The first element for developing a NAMA prioritization process is Defining a prioritization framework. This phase involves three steps: **Defining the objectives; Identification of criteria and indicators; and Weighting of criteria and indicators**.

A good decision making process requires clear objectives. Defining clear objectives is the first step to defining criteria, as the criteria will translate the objectives into a measurable basis for evaluating the options. The objectives should be specific, realistic and time-dependent. The objectives will be defined by considering a desired future state.

In case of NAMA prioritization process, as NAMAs are mitigation actions implemented in context of sustainable development of a country, the objectives will be defined by considering the future development state that a country would like to achieve. These objectives can be framed in terms of strategic vision, such as economic, social or environmental. In addition, NAMAs are an instrument for addressing the international climate change obligations of a country under the UNFCCC. Thus the international stance of the country under UNFCCC too should be considered in defining the objectives.

In case of NAMA prioritization process, the starting point for defining the objectives is thus the national context related to climate change and development priorities. These objectives may have already been determined by decision makers and defined in national or sectoral strategies or plans, such as national developments strategies/plans, national climate change strategy/plans, energy strategy, etc. The generic objectives for Prioritizing NAMAs can thus be defined by:

- Identifying the impacts of meeting the climate change policy of the country in response to its obligations under the UNFCCC;
- Identifying the developmental benefits of climate mitigation in order to strengthen the justification for climate mitigation and better integrate climate policy into national-level development-policy planning; and,
- Prioritizing investments related to mitigating greenhouse-gas emissions in order to decide allocation of limited finance across a large array of possible climate actions.

BOX 1 Identifying development priorities for the Philippines

The Philippines National Framework Strategy on Climate Change "aspires to chart a cleaner development path for the Philippines, highlighting the mutually beneficial relationship between climate change mitigation and adaptation". In this context, the Philippines initiated a process to identify priority NAMAs to achieve national sustainable development goals through low GHG emissions resilient growth.

As a first of Defining the framework, the following documents were reviewed to identify the national sustainable development priorities: the Philippine Development Plan (PDP); the Strategic National Action Plan on Disaster Risk Reduction (SNAP); National Priority Plan, the Investment Priorities Plan, and the Public Investment Program for 2011-2016 (PIP). As NAMAs are designed to address climate change, the National Climate Change Action Plan (NCCAP) was also reviewed.

Based on these documents, the following key development priorities were identified:

1. Rapid, inclusive and sustained economic growth
2. Poverty reduction and empowerment of the poor and vulnerable
3. Integrity of the environment and climate change mitigation and adaptation
4. Strengthening institutions and governance for transparent and participatory democracy

The second step in Defining the framework is the **Identification of criteria and indicators**. The criteria and their corresponding indicators are the parameters that are used to evaluate and measure the performance of the different NAMAs in achieving the objectives. This step is of high importance and has to be carefully performed as the criteria and indicators are the base to compare the performance of the NAMAs. The full list of criteria and indicators should reflect all the objectives defined at the first step from different perspectives including finance, social and environment.

In defining criteria following aspects should be considered:

- Criteria should be unique;
- Criteria should capture all important aspects of the objectives, so that the results of the prioritization are plausible and non-disputable;
- Criteria should be independent of other criteria. This implies that the impact measured by a criterion should not also be captured on other criterion. If the rating of options on two criteria is correlated, this would imply that criteria are not independent.

The criteria should be defined through a participative process. Before defining the criteria, the stakeholders should agree on the approach of selecting criteria. Such a process should integrate all the points of view expressed by the members of the stakeholders group.[9]

Criteria might be divided into sub-criteria and thus be organized in different levels. For example, as NAMAs have two main objectives (related to climate change and sustainable development), the top level criteria could include climate change and sustainable development as criteria. Each level of criteria is thus divided into further sub-criteria depending on the aspects that are covered by this criteria level. These sub-divisions ease the understanding on how the objectives are translated into evaluation criteria. For example, climate change and sustainable development criteria mentioned above could be sub-divided into sub-criteria: economic, social, environmental, and mitigation. The lowest level of sub-criteria should be so designed that each sub-criterion can be assigned a unique indicator to measure the impact of each NAMA on this sub- criterion.

The indicators are defined to provide practical values of performance of NAMAs. The indicators are expressed in monetary or non-monetary terms; in the case of the latter, they can be quantitative or qualitative. For each indicator it is good practise to include in the framework information on the method of estimating the indicator value and the sources of data. In defining the indicators it is thus important to consider that the data and information required for estimating indicator values are easily available and not costly to collect.

The third step in Defining the framework is the **Weighting of criteria and indicators**. This step is usually performed as a direct continuation of the second step. Weights reflect the relative preferences of criterion or against the others. The weighting of criteria and indicators should take into account the objectives defined at first step and reflect the priority given by a country to the specific objectives, for example the priority given by a country to economic, social or environment aspects.

The weighting could be done in a pare-wise comparison from the lowest level of sub-criteria. The approach is to reflect by pairs how much a sub-criterion is preferred compared to other sub-criterion. In this case, mathematical tools are required to translate the pair-wise preference into weights for all sub-criteria. Alternatively the weighting could be done by defining a preference range (for example from 1 to 10) and using it to give a value reflecting the importance of the sub-criteria at the lowest level. The individual values are then normalized so that the weights of these sub-criteria add up to 1.

[9] MCA4 Climate (http://www.mca4climate.info/) gives a generic framework that could be used as a starting point for defining criteria. This generic framework is developed for evaluating both policies and programmes. To that extent the framework should be adapted for NAMAs as well as take into account country specific requirements.

BOX 2 Criteria tree developed for the Philippines NAMA prioritization framework

Criteria level 1	Criteria level 2	Criteria level 3	Indicators
MITIGATION IMPACT	GHG	1.1 GHG emissions reduction/ sequestration	1.1 Potential of GHG emissions reduction (TCO_2eq)
	FEASIBILITY	1.2 Human capacity to implement the NAMA and to service technology	1.2 % of available trained personal with specific technical skills (#)
		1.3 Technological availability and supporting infrastructure	1.3 Level of readiness to absorb and implement the technology (qualitative)
		1.4 Financial cost	1.4 Total (capital and operational) cost of implementing the NAMA ($)
SUSTAINABLE DEVELOPMENT	ECONOMY	2.1 Enhance economic growth	2.1 Contribution to growth in sectoral/total GPD (%)
		2.2 Increase net Employment generation	2.2 Net number of new jobs created through the NAMA (#)
		2.3 Increase private sector investments	2.3 Increase in the amount of private investments (%)
		2.4 Enhance regional equity	2.4 Level of decentralised investments and jobs (qualitative)
		2.5 Enhance energy security	2.5 Reduction in energy import bill ($/year) – volume expressed in %
		2.6 Increase competitiveness	2.6 Decrease in the cost of production of goods and services (qualitative)
		2.7 Enhance macroeconomic stability	2.7 Reduction of public subsidies ($/year)
	SOCIAL	3.1 Sustain poverty incidence reduction	3.1 Reduction in poverty incidence (quantitative)
		3.2 Improve access to basic services	3.2 Increase of percentage of people with access to basic services: water, health, education, transport, modern energy (%)
		3.3 Increase ethnic and gender equality	3.3 Use the scale established by Government to design indicator (qualitative)
		3.4 Promote cultural preservation	3.4 NCIP (qualitative)
	ENVIRONMENT	4.1 Enhance environmental quality	4.1 Decrease in pollution (qualitative)
		4.2 Strengthen resilience & adaptive capacity to climate change	4.2 Increases resilience and adaptive capacity of natural, human and economic systems (qualitative)
		4.3 Enhance Sustainable Natural Resource Management	4.3 Improved conservation of natural resources (qualitative)

Process of Defining the framework

Multi-criteria analysis is a judgement based system. It is important that the framework reflects a well-balanced judgement of all the stakeholders important for implementing the options as well as those who will face the positive and negative impacts of implementing the options. The framework should therefore be developed through a consensus process in consultation with all the relevant stakeholders.

Entity responsible for NAMA coordination or for climate policy making and implementation is best suited to coordinate the process of Defining a NAMA prioritization framework (this entity is referred to as Technical Coordinating Entity -TCE- in Sharma and Desgain 2014). To run the process of defining the framework it is important to establish a core technical group. This group will help in preparing and the necessary documentation for undertaking the consultation process with all relevant stakeholders in finalizing the framework. Such a core technical group should include experts from climate change and sustainable development field. These experts should also have deep understanding of countries climate change policy and sustainable development priorities The main responsibility of this group is to review all the relevant policies, strategies that address sustainable development and climate change, in order to prepare the draft prioritization framework including objectives and criteria. These experts help in ensuring comprehensiveness and providing expert judgement of relevance of criteria.

The draft prioritization framework without the weights should then be circulated among a testing group of stakeholders to assess the objectives and criteria and provides inputs to ensure comprehensiveness of the prioritization framework proposed. The testing group is also the first step in assigning weights to the criteria. As this group represents the stakeholders it brings in the different perspectives and helps arrive at a collective judgement on importance of criteria. It is advisable to hold a workshop with this testing group to discuss the feedback and revise the draft.

Finally the draft prioritization framework should be consulted with a larger group of stakeholders representing governments as well as civil society organizations, private sector and research institutions. The finalization workshop should also invite experts from sectors where NAMAs are likely to be implemented. Experts can provide specific information on various aspects of actions and policies that may be part of NAMAs that are likely to be developed. The objective of such a workshop is seek feedback on comprehensiveness of criteria, feasibility of getting necessary data and information in scoring NAMAs against indicators, as well as on weights assigned to the criteria. It is important to share the full documentation on the NAMA prioritization framework well in advance to allow a better participation of the stakeholders. Further, testing the framework against a list of NAMAs allows participants to assess the framework and fine tune the criteria, indicators, and weights.

Chapter 5

PRIORITIZING NAMAS

A pre-requisite to start Prioritizing NAMAs is to have identified the long list of NAMAs (Sharma and Desgain, 2014).

Once the prioritization framework has been established, *i.e.* the criteria and indicators have been identified and their respective weights determined, the **Prioritizing NAMAs phase** can start based on the national long list of NAMAs. As summarized in Figure 2, Prioritizing NAMAs includes the four following steps: Scoring, Examine the results, Sensitivity analysis, Compilation of the results.

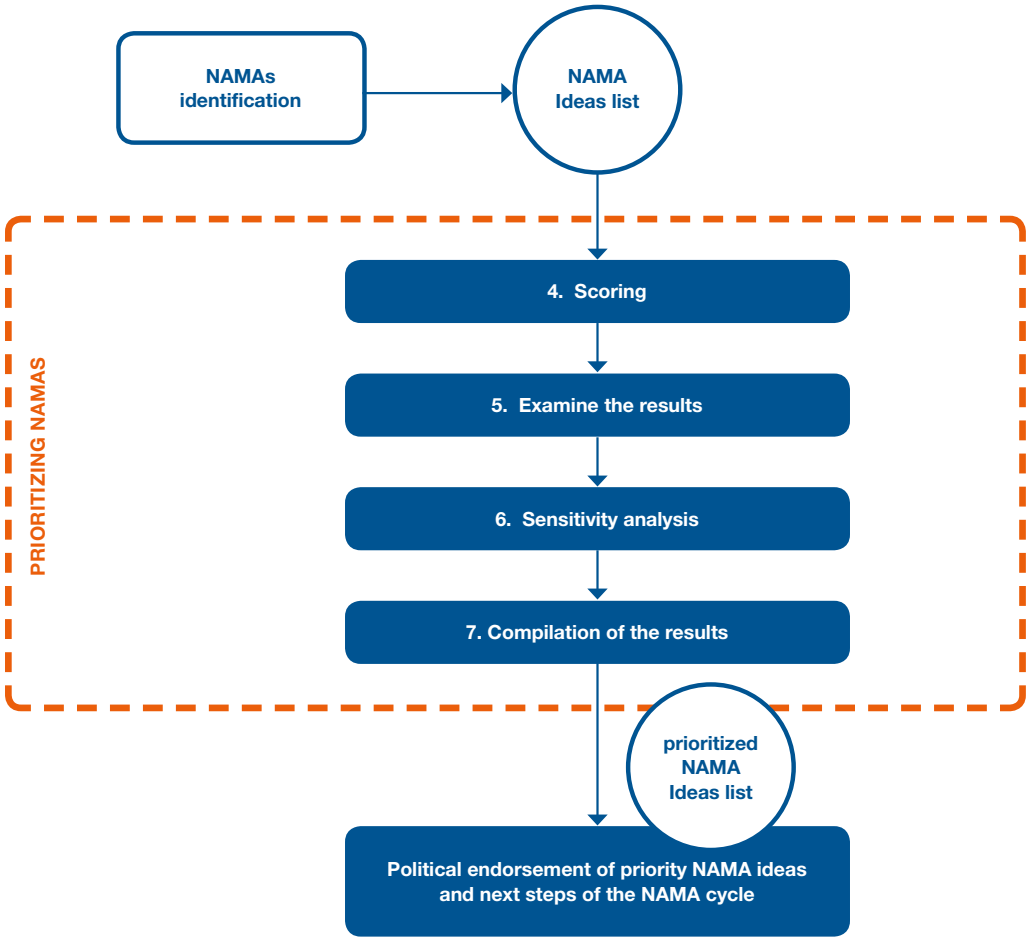

Figure 2: Steps for the Prioritizing NAMAs phase

The Prioritizing NAMAs process should be country-owned and country-driven. The process can be coordinated by a central entity, the TCE. It will be a participatory exercise organized through a workshop facilitated by a TCE representative or by a professional facilitator (to ensure neutrality of the process). The process will involve stakeholders representing the different sectoral working groups. Before the workshop a NAMA ideas list should be shared with all the stakeholders invited to the workshop together with the corresponding NAMA idea documents. These documents are one to two-page documents providing key basic information on each NAMA.

During the **Scoring**, all stakeholders involve in the process will assign a score to each indicator for each NAMA option. The score will be determined from the information included in the NAMA ideas documents. Therefore it is important that a common template, capturing all the information required to assess the NAMA on the criteria identified, should be used for NAMA idea document. All stakeholders should thus receive the NAMA ideas documents previous to the exercise to get familiar with all the NAMAs that will be involved in the prioritization. It is very important that all stakeholders involve in the process assign a score to all indicators for all NAMAs. Indeed, there is a risk that representative for a specific sector may score higher for NAMAs related to his own sector. The participation of all stakeholders is thus the only way to ensure that the different perspectives from the different stakeholders are taking into account and guarantee that the prioritization results reflect these differences. A good practise is that each stakeholder explains and justifies the value of the score given to each indicator for each NAMA option, especially if the value varies significantly from average score. This will allow opening the discussions for each indicator and option, and will eventually lead to reach a consensus on the values determined for each indicator. In this case the facilitator will have to ensure that the debates are not dominated by one or a small group of stakeholders.

Once all stakeholders have scored all indicators for all NAMA options, an average score can be determined for each indicator for each option. Based on the weights assigned to each indicator, a final weighted score can be determined for each indicator for each NAMA as well as a final global weighted score for each NAMA. These calculations, described in chapter 2, can be done by using a simple excel sheet. However when the number of indicators used and the number of NAMAs to be prioritized are high, it can be easier to use a MCDA tool software.[10] Usually the compilation of all the sores given by the stakeholders and the calculation are done by the TCE. The result of this step is a preliminary NAMA priority list with the top priority NAMA having the highest score. It is important to understand that the priority list does not have to be considered as a list giving a strict order to be followed to develop and implement the different NAMAs. This list gives an idea of what *group* of NAMAs could give the best impacts in terms of sustainable development and climate change in a given national context.

[10] Many MCDA tools can be purchased or are available for free on the internet.

The next steps are **Examine the results** and **Sensitivity analysis**. Once the preliminary NAMA priority list has been established, the preliminary results can be shared with all stakeholders for discussion and analysis. The purpose is to see if these results are in line with the results which could have been expected taking into account the national context, and to detect any incongruity in the process. It is also an opportunity for the different stakeholders to express their views on the preliminary results and open these results for further debate and discussion. It is also the time to apply a sensitivity analysis which is performed by changing the values of the weights, and see how the priority of the different NAMA options is affected by these changes. The sensitivity analysis is of particular importance when there are strong disagreements among the stakeholders, for example on the weights assigned to one or few indicators. Indeed it may so happen that changing slightly the weights of one or few indicators does not modify the whole prioritization results but modifies for example the order of the top prioritized NAMAs. In this case the group of NAMAs identified as having the highest priority does not change and further discussion on the issue could be obsolete. Of course, if the results of the prioritization process are highly affected by the sensitivity analysis, the causes will have to be further discussed among the stakeholders in order to reach a consensus on the final results to be adopted. The different results may also be described when compiling the results in the final report.

Once the sensitivity analysis has been done and that all stakeholders are satisfied with the results of the prioritization process, TCE can **compile the results** in a report. The report will summarize the prioritization process and present the prioritized NAMA ideas list. The report could also summarize the debates among the stakeholders and explain how the prioritized NAMA ideas list is affected by the different stakeholders' perspectives. This report including the prioritized NAMA ideas list will be submitted to political endorsement followed by the next steps of the NAMA cycle (Sharma and Desgain, 2014).

Chapter 6

CONCLUSIONS

Most countries are in the process of developing their intended nationally determined contribution (INDC) to be included in the new global climate agreement which is likely to be agreed by Parties in Paris during COP21. Further, to implement the mitigation contribution in their INDC, countries are also in the process of identifying mitigation actions. In this context, many countries will probably establish NAMAs prioritized list to select the mitigation actions to be implemented first.

MCDA is a tool used to support decision making process, which can be applied for prioritizing NAMAs. As NAMAs are mitigation actions taken in the context of sustainable development, the MCDA framework developed for NAMAs prioritization will be based on national sustainable development and climate strategies/policies. In this context, the NAMA prioritization framework should be country specific and based on national strategies and policies.

The NAMA prioritization process should be participative in order to ensure buy-in of the results by all stakeholders. In addition, the process relies on expert judgement (in particular for the criteria selection and for assigning weights to the criteria). It is thus important to involve the right stakeholders at each stage of the process so that the perspectives from different interest groups are reflected in the results.

Finally it has to be noted that a NAMA prioritization framework is not static and would be affected by changes in the national priorities and context. Thus the NAMA prioritization process should be reviewed as appropriate to take these changes into account.

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Multiple-criteria decision analysis (MCDA) is a tool commonly used for decision making process, including to rank options or to short-list a limited number of options. This tool allows combining some criteria which are valued in monetary terms and others for which market values are not readily available in the economy. It allows the use of a full range of social, environmental, technical, economic, and financial criteria. MCDA is thus an appropriate tool to prioritize NAMAs in the context of national sustainable development, taking into account climate and development priorities.

The objective of the publication is to enhance the knowledge of national stakeholders, in particular policy makers and decision makers, to understand the process for developing and applying a framework for NAMA prioritization (referred as NAMA Prioritization Process).The publication will address the technical aspects related to the use of the MCDA tool and the institutional arrangements to implement an MCDA process, both in the context of NAMAs prioritization. Philippines is used as case example to illustrate the application of MCDA in a country-specific context.

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